Technology Transfer

Naval Research Laboratory

FY01 Technology Transfer Annual Report

prepared by

Technology Transfer Office

October 2001

Many of the Naval Research Laboratory's (NRL's) technologies have commercial applications in addition to the defense-oriented objectives for which they were originally developed. NRL developments in areas such as radar, communications, satellite navigation, software, fiber optics, chemical and biological sensors, and a wide variety of materials and coatings have made significant contributions to the safety and welfare of the civilian community. The transitioning of NRL's dual use technologies to the commercial sector is facilitated by NRL's Technology Transfer Office. This office implements the Technology Transfer Act by which Congress authorized federal laboratories such as NRL to participate in Cooperative Research and Development Agreements (CRADAs) and patent licensing agreements. In the last ten years, NRL has entered into more than 250 CRADAs with industry, universities, non-profit organizations, and other government organizations. In addition, NRL has executed over 40 licenses to its inventions.

This report describes the history of technology transfer at NRL, summarizes NRL's technology transfer initiatives in FY01, and describes trends in NRL technology transfer. During FY01, NRL signed CRADAs on topics that range from fundamental investigations with long-term prospects for commercialization to projects that involved the implementation of mature technology developed for defense use into commercial systems.

Among Department of Defense (DoD) laboratories, NRL is a recognized leader in the area of technology transfer. In FY01, NRL inventors were presented with the Vice Admiral Harold G. Bowen Award in recognition of an important technology transfer to the operational Navy and four Federal Laboratory Consortium Awards for Excellence in Technology Transfer in recognition of the achievements of NRL inventors toward commercialization of their technologies.

NRL is proud of its record of technology transfer. NRL's Technology Transfer Office welcomes inquiries from across the NRL community and the private sector regarding how we can work together to transition NRL's leading edge technological developments into the next generation of products and services for the public.

Catherine M. Cotell, Ph.D.
Head, Technology Transfer Office

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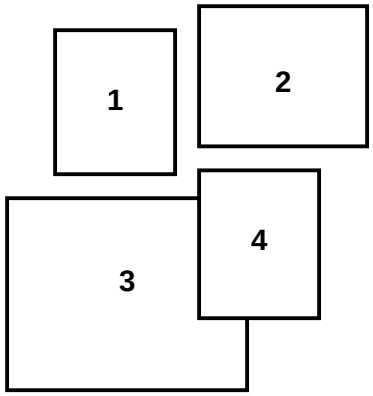

1. Small-scale, low-power Surface Acoustic Wave (SAW) chemical agent detector capable of real-time detection in the parts per billion range. Built-in telemetry relays data to remote processor.

2. Navy vessel used to test and evaluate antifouling coatings for marine environments. A license to this technology was signed in FY01 between NRL and Smart Surfaces, LLC.

3. Using a vision system equipped with NRL's Tripod Operator software, a robotic manipulator finds a torque converter and automatically moves the part from the skid to a fixture on a conveyer.

4. Composite image showing NRL's Tripod Operator software finding an automotive torque converter in a LIDAR image of palletized parts. The recognition process typically takes a fraction of a second.

U.S. Naval Research Laboratory
Technology Transfer Office
Annual Report FY01

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E.O Hartwig
Acting Director of Research
Naval Research Laboratory

OVERVIEW OF TECHNOLOGY TRANSFER AT NRL

Objectives

The objectives of the Technology Transfer Office at the Naval Research Laboratory (NRL) are to

- create alliances with industry and academia that will enhance and support the mission of the Laboratory; and
- facilitate the implementation of NRL's innovative technologies in products and services to benefit the public.

History of Technology Transfer at NRL

The following figures illustrate the history of the Cooperative Research and Development Agreement (CRADA) and patent license agreement (PLA) programs at NRL. Figure 1 shows the number of CRADAs and CRADA amendments signed annually from fiscal year 1989 through fiscal year 2001.

Figure 2 shows the distribution of active CRADAs at NRL, by Division. Figure 3 shows the distribution of income to NRL associated with all CRADAs that were active during FY01, by Division. NRL Divisions are identified by Division Code in Appendix A (page 15).

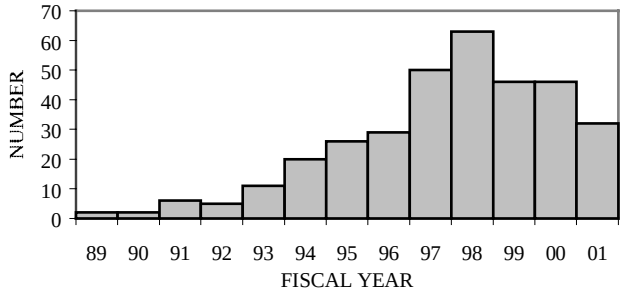
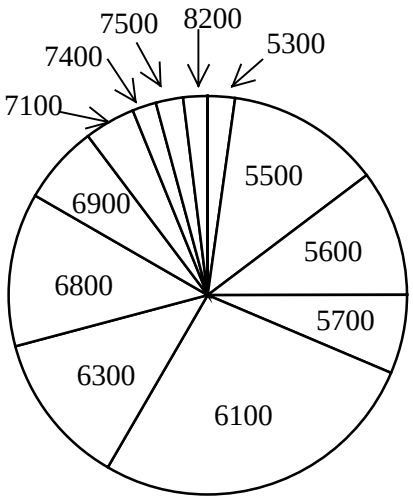
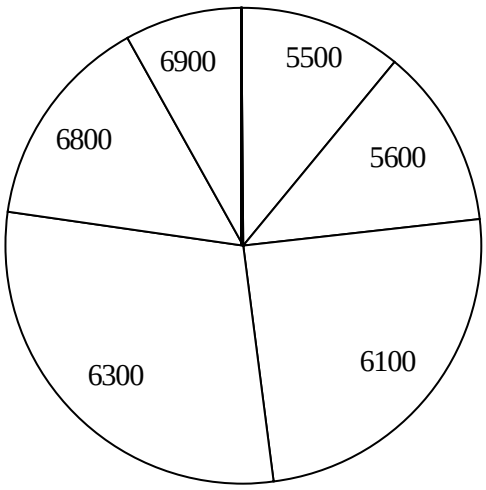


Figure 1 - Number of CRADAs and amendments signed from FY89-FY01.



Total number of CRADAs active during FY01: 48

Figure 2 - Number of CRADAs by Division.



Total income in FY01 from CRADAs active in FY01: $1,124,500

Figure 3 – Distribution of income received in FY01 from all CRADAs active during FY01, by Division.

Figures 4 and 5 show the number of new PLAs signed annually and the annual royalty income from PLAs signed in FY93–FY01.

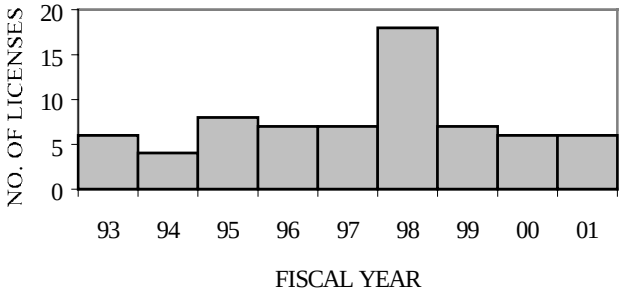


Figure 4 – Number of licenses signed from FY93–FY01.

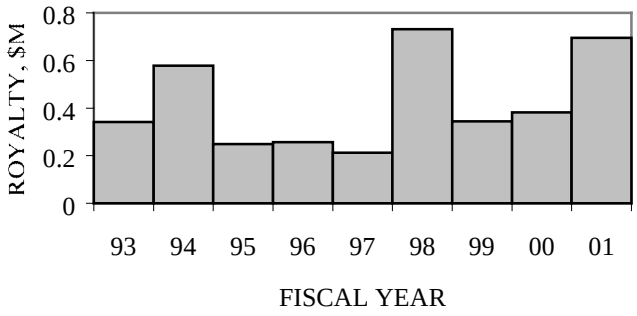
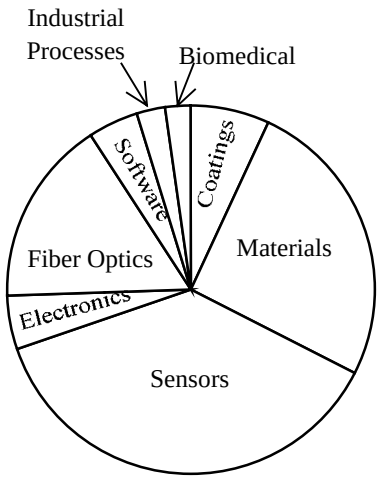


Figure 5 - Royalty income from licenses from FY93–FY01.

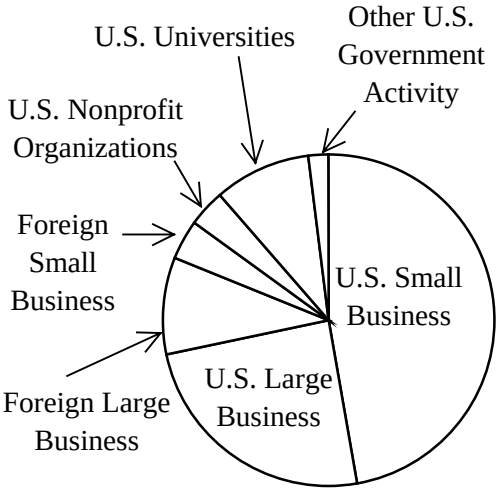


Total Number of Licenses Active in FY01: 43

Figure 6 – Distribution of active licenses by subject area.

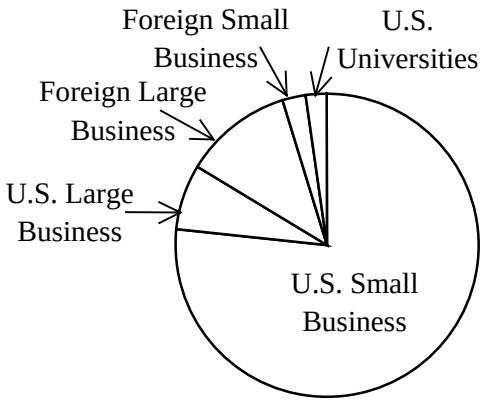
Figure 6 shows a breakdown of NRL's active licenses into the following categories: materials, sensors, electronics, fiber optics, coatings, software, biomedical, and industrial processes. Materials, sensors, and fiber-optics technologies represent the majority of NRL's active licenses.

Federal technology transfer legislation (e.g., the Bayh-Dole Act of 1980, the Small Business Innovation Development Act of 1982, the Small Business Technology Transfer Act of 1992 and several Defense Authorization Acts) includes provisions directed at enhancing and supporting small business ventures. As shown in Figure 7, a large fraction of NRL's active CRADAs and PLAs are with small businesses. Another goal of the legislation governing technology transfer at Federal Laboratories (e.g., the Bayh-Dole Act of 1980, the Stevenson-Wydler Technology Innovation Act of 1980, the Federal Technology Transfer Act of 1986 and the National Competitiveness Technology Act of 1989) is to encourage manufacturing in the United States. Figure 7 also shows the breakdown of NRL's active CRADAs according to whether the CRADA party or licensee is a foreign or domestic firm.



Total number of CRADA parties: 53

Figure 7 - Identification of parties with whom NRL had active CRADAs in FY01 according to the size of business, non-profit organization or university, and whether foreign or domestic. Note that the number of CRADA parties exceeds the number of CRADAs in Figure 2 because several CRADAs were multiparty agreements.



Total Number of Licenses Active in FY01: 43

Figure 8 – Distribution of NRL's active licenses according to the size of business, non-profit organization or university, and whether foreign or domestic.

Figure 8 shows the breakdown of NRL's active licenses according to size of licensee's business and whether the licensee is U.S.- or foreign-controlled. All of the foreign firms with whom NRL has signed licenses and CRADAs have agreed to manufacture the products derived from the agreements substantially in the U.S.

Staffing

The Technology Transfer Office at NRL consists of three full-time professional staff members and two administrative staff members, one of whom works part-time. With respect to technology transfer mechanisms, the primary responsibilities of the Technology Transfer Office are the execution of CRADAs and PLAs, as well as the maintenance of records of the non-disclosure agreements (NDAs) executed on behalf of NRL. The Technology Transfer Office works closely with the Office of Counsel at NRL. NRL's Office of Counsel for Patents is responsible for the following tasks related to the operation of the Technology Transfer Office: prosecution of patents, payment of filing and maintenance fees associated with NRL patents, and review of PLAs. The Office of General Counsel at NRL is responsible for reviewing CRADAs and NDAs, as well as coordinating with the NRL Contracts Division to process testing agreements and work for private party agreements.

Head of Technology Transfer

The head of NRL's Technology Transfer Office is Dr. Catherine M. Cotell. Dr. Cotell received her B.A. in chemistry and mathematics from Wellesley College and her S.M. and Ph.D. degrees from the Massachusetts Institute of Technology in metallurgy and materials science and engineering, respectively. After two years as a member of technical staff at AT&T Bell Laboratories, Dr. Cotell joined the staff of the Condensed Matter and Radiation Sciences Division in the Materials Directorate at NRL. Her research was in surface modification and thin film coatings for electronic, optical, and biomedical applications. She joined the staff of the Technology Transfer Office in June of 1997 and assumed the position of head of the Office in April of 1999.

As head of technology transfer at NRL, Dr. Cotell is responsible for enhancing the transfer of technology both to and from NRL. That is, the programs she administers support the transfer of technology from NRL to users of NRL R&D products as well as the transfer of technology from sources outside NRL to the Laboratory to enhance its mission. The head of the Technology Transfer Office is directly responsible for initiating programs that generate and stimulate the transfer of technology. These programs include the Office of Research and Technology Applications (ORTA) program; the stimulation, preparation, and guidance of CRADAs; the marketing of NRL's intellectual property patent portfolio; the negotiation and preparation of PLAs; the dissemination of technical information within and outside NRL; the facilitation of collaborations and interactions between NRL researchers and the commercial sector; and the stimulation of initiatives to develop the transfer of technology to other organizations. The Head of Technology Transfer is responsible for the technical assessment of the programs within NRL relative to opportunities arising external to NRL in the Navy, Department of Defense and sponsor communities. The Head of Technology Transfer is called upon to coordinate legal work in connection with negotiating PLAs, negotiating and settling patent claims, and negotiating patent clauses in contracts.

Technology Transfer Specialist

Dr. Celia Merzbacher holds the position of Technology Transfer Specialist. Dr. Merzbacher received her B.A. in geology from Brown University and her M.S. and Ph.D. degrees from the Pennsylvania State University, both in Geochemistry and Mineralogy. Following a post-doctoral research appointment at Lawrence Livermore National Laboratory, Dr. Merzbacher joined the staff of the Optical Sciences Division at NRL. Her research has been in aerogels and glassy materials for optical and electronic applications. She joined the staff of the NRL Technology Transfer Office in January 1999.

As Technology Transfer Specialist, Dr. Merzbacher is responsible for preparing application assessments for selected research and development projects for the Laboratory; providing and disseminating information on federally owned or originated products, processes and services having potential application to state and local governments, academia, and private industry; assisting the National Technical Information Service, the Federal Laboratory Consortium for Technology Transfer, and other organizations linking the research and development resources of NRL to State and local governments, academia, and private industry; participating in regional, state, and local programs to facilitate or stimulate the transfer of technology; providing insight for potential and existing CRADAs; assisting NRL program/technical managers to identify technologies suitable for transfer; coordinating domestic technology transfer efforts with small and disadvantaged businesses for the purpose of stimulating commercialization of appropriate technologies by small businesses; and preparing pamphlets and brochures to be distributed to interested parties.

Program Analyst

The Program Analyst position in the NRL Technology Transfer Office was vacant during FY01 while Ms. Dorothy Vincent filled a detail position in the Industrial Programs Office at the Office of Naval Research (ONR) where she was responsible for administrative monitoring and record keeping for the technology transfer efforts of the Navy at large.

The responsibilities of the Program Analyst in the NRL Technology Transfer Office include planning, developing, analyzing, and implementing automated systems and databases necessary to transfer NRL technology to the private sector and to government agencies efficiently; preparing charts, graphs, statistical and narrative data for presentations, briefings, and exhibits; analyzing and preparing CRADAs and PLAs to ensure compliance with Technology Transfer legislation and Navy policy; providing online data searches; preparing year-end reports of CRADA and PLA activity; maintaining the records for NRL's Technology Transfer input to the Office of Naval Research Defense Technology Information Systems (DTIS) database used to track CRADA and PLA activity; maintaining an in-house database to track PLA activity in various stages of progress; compiling relevant information (assignments, patents, filings, notices) pertinent to PLAs; and acting as liaison between the Technology Transfer office and the NRL Public Affairs Office to coordinate and distribute inventor fact sheets.

FY01 IN REVIEW

Intellectual Property

The information in Table 1 was provided by the Office of Counsel to summarize intellectual Property actions at NRL during FY 01. This information is pertinent to technology transfer at NRL because most technology transfers involve the protection and transfer of rights in intellectual property. For the first time in FY01, the number of trademark applications is included in this report. Trademarks are a tool that NRL is using with increasing frequency, especially to protect software developments. Occasionally NRL-developed software is made available for public use without a PLA. In these cases, the objective of trademarking the name by which the software is known both ensures that NRL receives proper credit for the development of the software and assures quality control for any software that might bear the trademarked name but is developed by outside parties as enhancements to NRL software.

Table 1 - Intellectual Property Actions Taken by NRL in FY01

Invention Disclosures Filed	85
U.S. Patent Applications Filed	98
U.S. Patents Issued	64
Total Number of U.S. Patents to which NRL held title	662
Trademark Disclosures Filed	5
Trademark Applications Filed	2

Cooperative Research and Development Agreements

A summary document describing the CRADAs signed by NRL in FY01 is attached as Appendix B. NRL entered into 14 new CRADAs and signed 18 amendments to existing CRADAs. Two CRADAs were terminated by mutual agreement between NRL and the other CRADA party. The total income to NRL associated with the CRADAs and CRADA amendments signed in FY01 is $1,199,500. This figure represents the total funding associated with CRADAs signed in FY01. Not all the funding was received in FY01; many of the CRADAs were multiyear agreements with funding schedules that extend over the duration of the programs. Similarly, this amount does not include funds received in FY01 from CRADAs signed in previous years.

Table 2 and Figures 9 and 10 show the distribution of the new FY01 CRADA activity and income over the different Divisions at NRL. Table 3 and Figures 11 and 12 show the distribution of FY01 CRADA amendments and associated income. The total funding from new CRADAs and amendments to existing CRADAs signed in FY01 is broken down by NRL Division in Figure 13.

Five of the fourteen new CRADAs signed in FY01 do not include direct funding from the non-Navy party to NRL. In some of these unfunded CRADAs, NRL's effort is supported with funds from Government sponsors other than NRL, for example, DARPA, NAVAIR, DTRA, and the U.S. Army. In the other cases, NRL's effort under the CRADA is supported by, and falls under the scope of, current in-house programs. For collaborative research in which each party funds its own efforts, the CRADA vehicle is useful to define the responsibilities of the parties toward achieving the objective of the collaborative research and to identify procedures for the protection of intellectual property.

Some NRL technology transfers via CRADAs directly support Government priorities and programs. For example, a CRADA that was signed in FY01 among NRL, NAVAIR, and Pall Aeropower Corporation supports the development of a system for removing copper ions from jet fuel. Contamination by as little as 10 parts per billion of copper in jet fuel can lead to clogging of engine nozzles. In addition, exposure of fuel to copper during storage can cause degradation of the fuel, leading to reduced engine performance and increased maintenance costs. The Navy's goal is to filter out copper at a rate of up to 2,000 gallons of fuel per minute.

Other CRADAs are clearly dual use. One dual use CRADA in FY01 supported the commercialization of technology that NRL had previously licensed to the other CRADA party. Under a license originally signed in 1993, Quantum Magnetics, Inc. has used NRL's nuclear quadrupole resonance technology to develop a device for screening both checked and carry-on luggage for explosives and other hazardous materials. Since signing the license, Quantum Magnetics and NRL have continued to work collaboratively to improve the technology. Under a current CRADA, NRL is evaluating the ability of Quantum Magnetics' advanced electronics to improve detection of contraband chemical compounds, such as TNT. The importance of devices to improve airport security was underscored by the terrorist attacks on the Pentagon and the World Trade Center on September 11, 2001.

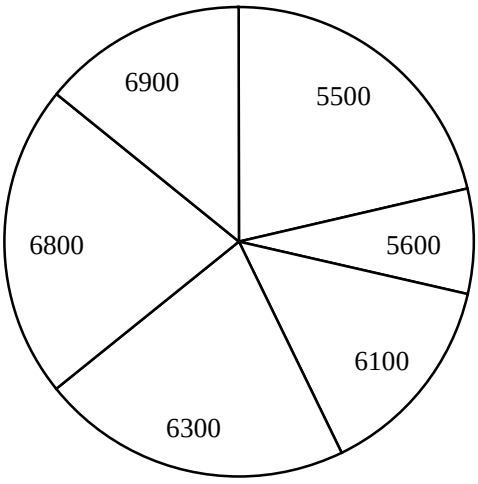
Several CRADAs signed during FY01 are focused on further developing NRL sensor technologies for both military and commercial applications. For example, under the scope of two separate CRADAs, Constellation Technology Corporation is working to enhance its line of sensor products to include both biomolecular and chemical sensing capabilities. Under another CRADA, NRL and Triton Systems, Inc. are working to implement NRL's neural network algorithm, originally developed for shipboard fire detection, for sensitive detection of hazardous or toxic compounds in aqueous solutions, including seawater.

Another dual use collaboration to develop sensor-related technology took place under a CRADA between NRL and a team of companies that includes The Ford Motor Company and Perceptron, Inc. The team is completing the fourth year of an Advanced Technology Program (ATP) funded by NIST to develop advanced robotic technology for assembly of automobiles. Under the CRADA, the participants have enhanced NRL's software for rapid determination of the location and orientation of objects and demonstrated it in a robotic system for automotive manufacture. A photograph of the robot arm being controlled by the NRL positioning software is shown on the cover of this report.

In many cases, including the examples given above, NRL has right and title to background inventions on which the CRADA work is based. As a result, if the CRADA is successful and a commercial application is developed, then a license will likely be negotiated to allow commercial sales of products or services using the background technology as well as the technology developed under the CRADA.

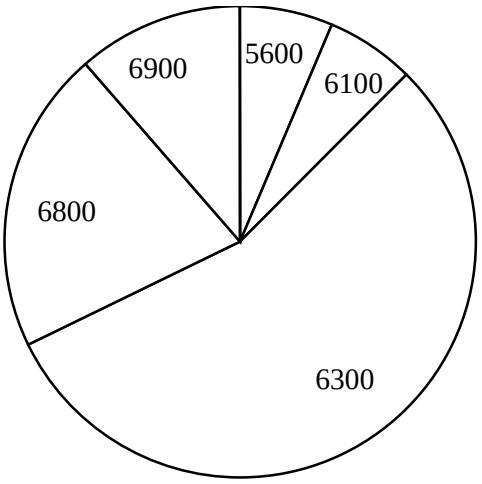
Table 2 - Number of CRADAs and Associated Income for New CRADAs Signed in FY01

Division	Number of CRADAs	CRADA Income ($)
5200	0	0
5300	0	0
5500	3	0
5600	1	50,000
5700	0	0
6100	2	50,000
6030	0	0
6300	3	440,000
6400	0	0
6700	0	0
6800	3	165,000
6900	2	91,000
7100	0	0
7200	0	0
7300	0	0
7400	0	0
7500	0	0
7600	0	0
8100	0	0
8200	0	0
Total	**14**	**796,000**



Total number of new CRADAs signed in FY01: 14

Figure 9 – Distribution of new FY01 CRADA activity by NRL Division.

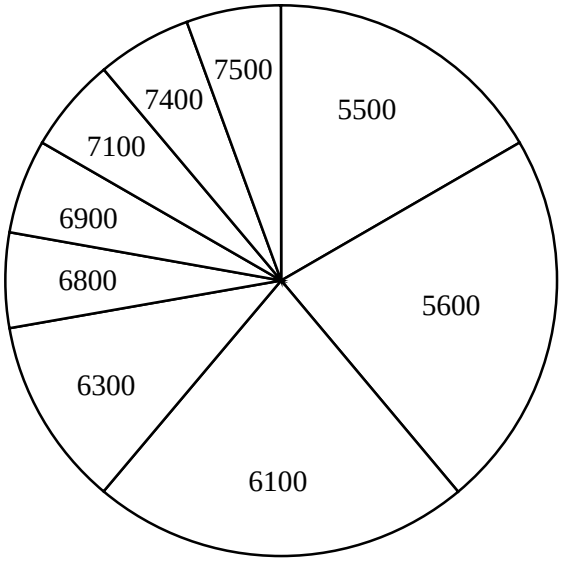


Total funding from new CRADAs signed in FY01: $796,000

Figure 10 – Distribution of new FY01 CRADA income by NRL Division.

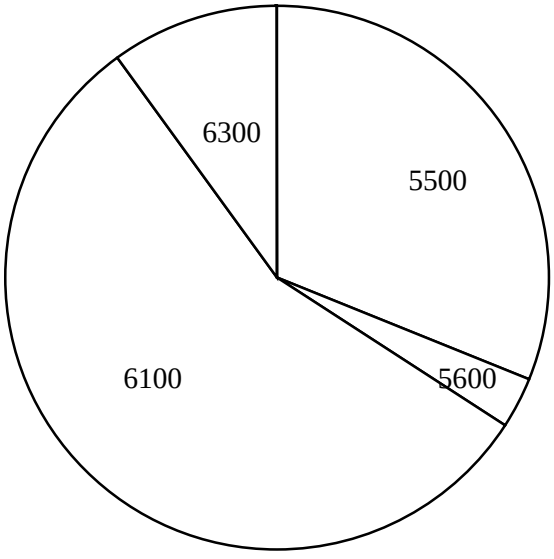
Table 3 – Number of CRADA Amendments and Associated Income for New CRADA Amendments Signed in FY01

Division	Number of Amendments	CRADA Amendment Income ($)
5200	0	0
5300	0	0
5500	3	125,000
5600	4	13,000
5700	0	0
6030	0	0
6100	4	225,500
6300	2	40,000
6400	0	0
6700	0	0
6800	1	0
6900	1	0
7100	1	0
7200	0	0
7300	0	0
7400	1	0
7500	1	0
7600	0	0
8100	0	0
8200	0	0
Total	**18**	**403,500**



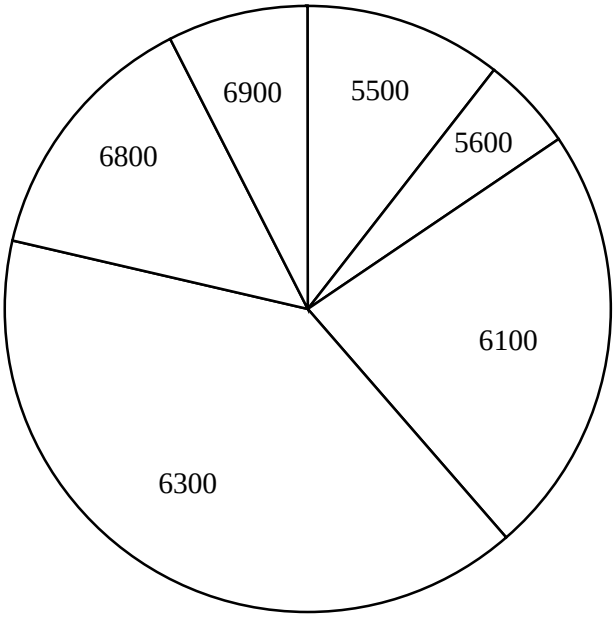
Total number of amendments signed in FY01: 18

Figure 11 – Distribution of amendments to CRADAs in FY01 by Division.



Total FY01 CRADA Amendment Funding: $403,500

Figure 12 – Distribution of FY01 CRADA amendment income by Division.



Total Funding from FY01 CRADAs and Amendments: $1,199,500

Figure 13 – Distribution of income from all CRADAs and CRADA amendments signed in FY01 by NRL Division.

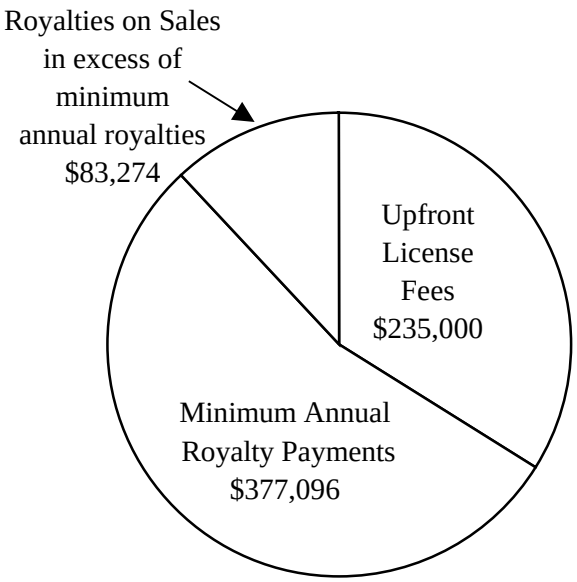


Figure 14 - Type of royalty income received in FY01

Patent License Agreements

A summary document describing the PLAs signed by NRL in FY01 is attached as Appendix C. NRL entered into six new PLAs and amended two existing PLAs in FY01. NRL approved one sublicense agreement in which a partially exclusive licensee granted sublicense rights to the NRL licensed technology to another party. Four PLAs were terminated in FY01. NRL terminated two PLAs when the licensees breached terms of the license agreements. A third PLA was terminated at the request of the licensee, following an unfavorable ruling by the USPTO on an interference case involving the licensed patents. A fourth PLA was terminated in association with the signing of a new license agreement with the same licensee under different terms. The total licensing fee and royalty income to NRL in FY01 from all active PLAs was $695,370, which represents over 60% of the total royalty income collected by the Navy as a whole.

Figure 14 shows the breakdown of FY01 royalty income according to type of payment: upfront licensing fee, minimum annual royalty payment, or royalty on sales of royalty-bearing product in excess of the minimums. The fraction of licensing income derived from royalties on sales of products is increasing annually. This trend is expected to continue as the companies with whom NRL signed its earlier licenses begin to bring products to the market.

Technologies for optical telecommunications dominated the licenses signed by NRL in FY01, accounting for four out of the six FY01 licenses. Calmar Optcom licensed three patents of Dr. Thomas Carruthers and coworkers in NRL's Optical Sciences Division. Calmar is selling a 40 Gb/s pulsed fiber laser source, shown in Figure 15. Because the NRL technology is scaleable, Calmar plans to introduce 80 and 100 Gb/s products as well.

Figure 15 – Calmar Optcom's 40Gb/s RZ pulsed fiber laser source, offering unique high power, high quality RZ pulses that are continuously tunable over the entire c-band, is sold under license from NRL.

Figure 16 – CODEON's Mach-40™ high performance External Optical Modulator, designed to transmit data at 40+ Gb/s, is sold under license from NRL.

Codeon, a company founded in part by former NRL scientist, Dr. William Burns, licensed two of Dr. Burns' patents that are used to manufacture Codeon's line of optical modulators. Codeon's modulators are designed for high speed optical telecommunications. Figure 16 shows Codeon's Mach-40™, a 40 Gb/s modulator. These modulators were first delivered to customers for evaluation early in calendar year 2001.

The NRL method for side-pumping an optical fiber known as the "V-groove amplifier," invented by Dr. Lew Goldberg and licensed to Optocom Innovation (now Keopsys, Inc.) in FY00, was licensed by two additional companies in FY01: Fibertek, Inc. and IMRA America.

The ongoing programs in NRL's Chemistry Division directed at the development of antifouling coatings for marine environments led to a license agreement between NRL and Smart Surfaces Inc. Smart Surfaces intends to commercialize the fouling release coatings invented by Dr. James Griffith. When surfaces such as ship hulls or water intake pipes are coated with the Griffith formulations, marine fouling is removed by the action of water flowing over the surface. Flow rates or hull speeds of 18 knots are sufficient for cleaning.

Marine Desalination Systems licensed a technology invented by Dr. Max, formerly of NRL's Marine Geosciences Division, and Dr. Robert Pellenbarg, formerly of NRL's Chemistry Division. The patent describes a novel method for seawater desalination using clathrates, in particular, methane hydrate. The company is constructing a prototype apparatus to demonstrate that the method is sufficiently scaleable to be used for municipal water supplies.

Figure 17 – PriTel's Ultrafast Optical Clock, an easy-to-use actively mode-locked fiber laser providing high pulse-repetition frequencies and high average output powers for 1550 nm time-division-multiplexed communications R&D, sold under license from NRL.

NRL licenses from previous years are starting to result in products on the market. An example is shown in Figure 17. PriTel's Ultrafast Optical Clocks are among the PriTel products sold under license from NRL. Other PriTel products using technology invented by Dr. Tom Carruthers and coworkers in NRL's Optical Sciences Division include optical transmitters.

Assignment Agreements

Collaborations of NRL scientists with faculty at universities under the scope of Navy or other U.S. Government funding often lead to the joint development of intellectual property. The patents resulting from the joint work may have inventors from both NRL and the universities and are reported by the universities as Subject Inventions under their Government contracts. In accordance with 35 U.S.C. §202(e), NRL may assign its rights in the patents filed on these Subject Inventions to the universities in exchange for a share in royalties or other income the universities may derive from licensing the inventions. Such assignment agreements are a good way for NRL to cooperate with the universities to license the technology to third parties, especially when the university may already have title to prior work that together with the Subject Invention forms a portfolio of

commercially valuable technology. In some cases, the universities may already have licensed the prior inventions and the licensee may be interested in the improvement made jointly with NRL scientists. NRL executed one such royalty-bearing assignment in FY01 and is receiving royalties from another such assignment executed in 1993 with the University of Texas Health Sciences Center. The University of Texas licensed the technology to Nycomed Amersham in 1999. These royalties are reported as FY01 royalty income and are represented in Figure 6.

Sales of Goods and Services to Non-Federal Parties

Sales of Goods and Services to Non-Federal parties fall under three categories: testing authorized under 10 U.S.C. §2539b; services or supplies authorized under 10 U.S.C. §2563; and testing or other quality assurance demonstration for offerors authorized under 10 U.S.C. §2319. These sales are processed through the Office of Counsel and the Financial Management Division at NRL, not the Technology Transfer Office. They are included in this report because even though these sales do not constitute cooperative research or confer intellectual property rights, they may transfer NRL's technology or catalyze future technology transfer. The Technology Transfer Office and the Office of Counsel work closely together and on a case-by-case basis determine whether the work proposed to be done under these statutory authorities would more appropriately be done under the scope of a CRADA and reciprocally whether certain proposed CRADAs would more appropriately be handled under these other statutory authorities.

In FY 01, NRL sold goods or services under 10 U.S.C. §2539b and 10 U.S.C. §2563. Appendix D describes the goods and services sales approved in FY01. Financial data reported in Appendix D are projections over the life of each project initiated in FY 01, not actual receipts for FY 01.

Vice Admiral Harold G. Bowen Award

On September 13, 2001, NRL inventors Dr. Dennis R. Hardy, Ms. Erna Beal, and Mr. Jack C. Burnett (deceased) of the Chemistry Division were presented with the Vice Admiral Harold G. Bowen Award in recognition of their invention of a Method for Assessing Distillate Fuel Stability by Oxygen Over Pressure (Figure 18). The Bowen Award was presented by Dr. Fred Saalfeld, Executive Director/Technical Director for ONR. The Bowen Award is named in honor of the first Chief of Naval Research. The award recognizes patented inventions of present or past Navy employees that have had a significant impact on the operation of the Navy. A single Bowen Award is given each year. The invention recognized with this year's award is a referee test method for ensuring the long term (up to three years) strategic storage of approximately 800 million gallons of distillate fuel procured each year for Navy shipboard propulsion and power generation (non-nuclear). The cost to the Navy is about $4 billion annually including procurement, storage, and transport. The NRL test method was adopted by the American Society for Testing and Materials (ASTM) as a standard by committee D2 on petroleum products. ASTM standards are recognized and used worldwide. The invention has been incorporated into the military specification for bulk procurement of all shipboard distillate fuel as MIL-SPEC 16884J. This MIL SPEC is recognized by NATO and has been incorporated by other nations in numerous national fuel specification and testing documents in countries including Australia, Israel, and Saudi Arabia.

Figure 18 – 2001 Bowen Award winners Dr. Dennis Hardy (left) and Ms. Erna Beal.

Federal Laboratory Consortium Awards for Excellence in Technology Transfer

NRL's achievements in technology transfer were recognized with four Federal Laboratory Consortium (FLC) Awards for Excellence in Technology Transfer in 2001, the highest number that could be awarded to any federal laboratory under the FLC rules.

Drs. Jerry Meyer, Craig Hoffman, Filbert Bartoli, and Igor Vurgaftman (Figure 19) of the NRL Optical Sciences Division received one of the four awards for their successful transfer of the Quantum Mobility Spectrum Analysis (QMSA) technology to LakeShore Cryotronics. Under license from NRL, Lake Shore sells instrumentation for electronic transport measurements for process control to semiconductor manufacturers and researchers.

Mr. Vincent Park, of NRL's Information Technology Division, was awarded the second FLC Award in recognition of his participation in the transfer of the Temporally Ordered Routing Algorithm (TORA). TORA supports the extension of Internet-type services to users on the move or in remote locations. Mr. Park pursued standardization of protocol by participating in the Internet Engineering Task Force (IETF), and TORA is now sold under license from NRL as an option for the NovaRoam 900, a wireless router product manufactured by Nova Engineering, Inc.

A third FLC Award for Excellence in Technology Transfer was presented to Dr. John Reintjes, Dr. John Tucker, Dr. Abraham Schultz, Mr. Jefferson Willey, Ms. Amy O'Brien (all of the NRL Optical Sciences Division), Prof. Lawrence Tankersley (U.S. Naval Academy), Mr. Paul Howard (P.L. Howard Enterprise, Inc.), Prof. Chao Lu (Towson University), and Mr. Scott Thomas (American Communication Systems), in recognition of their successful transition of the LaserNet Fines technology both to the operational Navy and to commercial production. LaserNet Fines is an all-optical method for monitoring and analyzing wear debris in engine lubricating fluid. Developed initially for the Navy to enhance condition-based maintenance programs, LaserNet Fines is now sold commercially by Lockheed Martin under license from NRL. Figure 20 shows the LaserNet Fines team with Dr. Celia Merzbacher of NRL's Technology Transfer Office at the FLC Awards ceremony in May of 2001.

The final FLC Award for Excellence in Technology Transfer was presented to Drs. Richard Colton, David Kidwell, Gil Lee, David Baselt, and John-Bruce Green of the NRL Chemistry Division (Figure 21). The group was recognized for the development and transfer of biosensor technology based on atomic force microscopy (AFM) that is capable of detecting and characterizing single biomolecules, including DNA, viruses, and bacteria. The technology was

Figure 19 – 2001 FLC Award for Excellence in Technology Transfer winners, left to right, Drs. Craig Hoffman, Igor Vurgaftman, Jerry Meyer, and Filbert Bartoli shown in their laboratory.

Figure 20 – Dr. Merzbacher of the Technology Transfer Office at the FLC Awards Ceremony with members of one of the NRL teams that received the FLC Award for Excellence in Technology Transfer. Left to right: Mr. Paul Howard (P.L. Howard Enterprise, Inc.), Prof. Chao Lu (Towson University), Dr. Celia Merzbacher, Mr. Scott Thomas (American Communication Systems), Dr. John Reintjes (NRL Optical Sciences Division), and Dr. John Tucker (NRL Optical Sciences Division).

Figure 21 – 2001 FLC Award for Excellence in Technology Transfer winners, Dr. Richard Colton (left) and Dr. David Kidwell of the Chemistry Division.

originally conceived for detection of biological warfare agents, but it has a broad range of potential commercial applications that are presently being exploited.

FY01 Trends

The funding associated with CRADAs and amendments signed in FY01 increased ~6% over FY00. The total number of CRADAs and amendments signed was down somewhat, primarily due to fewer amendments. Funding actually received in FY01 under all active CRADAs, irrespective of the year in which the agreements were signed decreased relative to FY00. It is worth noting, however, that several CRADAs signed in FY01 are related to other Government-sponsored programs that are funding the work at NRL. The distribution among the Divisions of new CRADAs signed shifted slightly. For example, the Information Technology Division entered into more CRADAs in FY01 than in past years.

NRL's licensing program continues to be dominated by materials and materials-related technology originating in Codes 5000 and 6000. The number of licenses to fiber-optic technologies with applications in the optical telecommunications industry has grown significantly in the last two years. Despite the downturn in the telecommunications market in the last eight months, the companies to whom NRL has licensed its optical telecommunications patents appear to be stable, at least for the time being.

As shown in Figure 15, for the first time in NRL's licensing history, royalties from sales over and above the minimum annual royalties were significant, accounting for 12% of royalty income. Minimum annual royalty payments accounted for 54% and upfront licensing fees accounted for 34% of the royalty income to NRL in FY01. It should be noted that in some cases the minimum annual royalty payments do represent royalties on actual sales, not simply a license maintenance fee. Actual royalties on sales amounted to approximately $120,000, or 17% of total royalty income. At latest count, there were over 112 products on the market under license from NRL.

NEW INITIATIVES

In FY01 considerable effort in the Technology Transfer Office was directed at improving the database and record-keeping capabilities related to technology transfer and intellectual property actions. Representatives from the Technology Transfer Office and the Office of Counsel for Intellectual Property conducted a survey of users of docketing software designed for patent law firms and evaluated the recommended packages to determine which, if any, of the packages would provide NRL with the record-keeping and reporting capabilities required for NRL to meet its reporting requirements to the DoD and Congress. Royalty funds were used to purchase a Microsoft Access-based system that is compatible with the web-base invention disclosure system developed in the Technology Transfer Office in FY00. Moreover, ONR has agreed in principal to allow file transfer between the NRL database and ONR's Intellectual Property Management Information System (IPMIS). NRL's system will be demonstrated to other Technology Transfer professionals in the Department of Defense (DoD) at the DoD Technology Transfer Integrated Planning Team (TTIPT) meeting in November of 2001.

During FY01, the Technology Transfer Office worked closely with the NRL Office of Counsel to update the standard NRL Nondisclosure Agreement, as well as the procedures whereby such agreements are processed. Effective in July 2001, the Technology Transfer Office now serves as a

single point of contact for the maintenance records and copies of all signed NDAs.

The Technology Transfer Office was involved in FY01 with a number of initiatives directed at improving Technology Transfer from the Navy, the DoD, and the Government at large. By invitation of the conference organizers, NRL's Head of Technology Transfer organized and ran a special interest group session at the annual meeting of the Association of University Technology Managers (AUTM) on "Working with the Federal Laboratories." This session was designed to acquaint university technology transfer professionals and licensing executives with the Government's technology transfer programs. The objective was to increase dialogue between universities and federal laboratories to encourage cooperation in the licensing of jointly made inventions to make federally funded technologies available to the public on the commercial market.

NRL's Technology Transfer Office made a number of contributions to the Navy's technology transfer program. Both professional staff members were members of the committee that revised the standard Navy CRADA. NRL's Technology Transfer Specialist, Dr. Merzbacher, was a particularly valuable member of the committee, lending NRL's experience as the Navy's leader in numbers of CRADAs and licensing agreements. Dr. Merzbacher was selected to present the new CRADA at the annual meeting of the Federal Laboratory Consortium for Technology Transfer in May of 2001.

By invitation of the conference organizer, NRL's Head of Technology Transfer delivered a presentation on technology licensing from the perspective of a Government licensor to the "Capturing the Value of your IP" Conference sponsored by the Naval Underwater Weapons Center (NUWC) in Newport, RI in August of 2001.

NRL Technology Transfer staff also participated in the Navy-Industry Partnerships Conference held in August of 2001. The Head of the Office assisted two other NRL scientists to run a breakout session on Nanotechnology, and NRL's Technology Transfer Specialist organized a breakout session entitled "Partnering with the Navy Laboratories: Transferring Technology into the Fleet and Out to Commercial Products." The Technology Transfer Office arranged for NRL to have a booth at this conference's exhibits program and coordinated two NRL scientists to display their technologies at the booth.

NRL's Head of Technology Transfer participated on the Navy Lab cell of the ONR-sponsored Technology Transition Wargame in April of 2001 and provided input to the game organizers prior to the event to assist in game planning.

Appendix A

NRL RESEARCH DIVISIONS

Code	Name
5200	Technical Information
5300	Radar
5500	Information Technology
5600	Optical Sciences
5700	Tactical Electronic Warfare
6030	Laboratory for Structure of Matter
6100	Chemistry
6300	Materials Science and Technology
6400	Laboratory for Computational Physics and Fluid Dynamics
6700	Plasma Physics
6800	Electronics Science and Technology
6900	Center for Bio/Molecular Science and Engineering
7100	Acoustics
7200	Remote Sensing
7300	Oceanography
7400	Marine Geosciences
7500	Marine Meteorology
7600	Space Science
8100	Space Systems Development
8200	Spacecraft Engineering

Appendix B

FY01 CRADA REVIEW
1 October 2000 to 30 September 2001

NEW CRADAs

99-248
Filter-Based Removal of Copper Ions from Jet Fuel
CRADA among NRL, The Naval Air Systems Command (NAVAIR) and Pall Aeropower Corporation (PAC)

NRL Principal Investigators: Eddie Chang, Code 6930 and Robert Morris, Code 6121
NAVAIR Principal Investigator: Richard Kamin, Code AIR 4.4.5
PAC Principal Investigator: Tom Rountree
Funding: Each party will fund its own efforts
Other Government Funding: $38,000 from NAVAIR
Duration: 36 months
Signed: 2 October 2000

The ultimate objective of this CRADA is to develop a system for removal of copper ions from fuel for both land-based and shipboard applications capable of operating at up to 2,000 gallons per minute (gpm). In order to meet this objective, the following components and systems will be developed and/or tested:

- •20-gpm filter elements
- •600-gpm filter system for land-based applications
- •Direct-replacement coalescer/copper removal elements for shipboard applications

00-261
Development of Piezoelectric Noise and Vibration Instrumentation
CRADA Between NRL and Wilcoxon Research, Inc. (WRI)

NRL Principal Investigator: David Lewis, III, Code 6354
WRI Principal Investigator: Paul Wlodkowski
Funding: $20,000
Duration: 33 months
Signed: 1 December 2000

The objectives of this CRADA are (1) the identification and characterization of transducer-grade piezoelectric materials with appropriate and reproducible properties, and (2) the development of novel sensors and actuators that utilize the most promising of these new materials.

00-275
Combination of Ion-Mobility Spectrometry (IMS) and Surface Acoustic Wave (SAW) Technology in a Single Chemical Agent Detector
CRADA Between NRL and Graseby Dynamics, Ltd. (GDL)

NRL Principal Investigator: R. Andrew McGill, Code 6375
GDL Principal Investigator: Basil Polychranopoulos
Funding: $250,000
Duration: 12 months
Signed: 2 October 2000

The objective of Phase I of this CRADA is to evaluate the feasibility of combining NRL's SAW and GDL's IMS sensor technologies into a single chemical agent detector that is more robust and less prone to false positive or false negative alarms. The objective of Phase II of this Agreement is to develop the hardware and software for an integrated IMS-SAW detector.

00-279
Radiation Response Analysis of Advanced Multi-Junction Space Solar Cells
CRADA Between NRL and Tecstar, Inc. Applied Solar Division (TASD)

NRL Principal Investigator: Robert Walters, Code 6825
TASD Principal Investigator: P.K. Chiang
Funding: $40,000
Duration: 12 months
Signed: 14 February 2001

The objectives of this CRADA are to improve the hardness of TASD next generation triple-junction solar cell, the Tec III Cell, to the space radiation environment based on initial measurements of proton and electron radiation effects and to perform a full radiation response characterization of improved Tec III Cells.

00-283
Scalable Wireless Networking
CRADA Between NRL and University of Maryland (UM)

NRL Principal Investigator: Jeffrey Wieselthier, Code 5521
UM Principal Investigator: John Baras
Funding: Each party will fund its own efforts
Other Government Funding: $80,868 from DARPA
Duration: Expires 31 December 2001
Signed: 18 June 2001

The objectives of this CRADA are to develop a better understanding of the scalability issues associated with dynamic, wireless networks (in particular, with multicasting and intradomain routing) and to assess the scalability of related network algorithms.

00-285
Development of AlGaN/GaN Ultraviolet Sensors
CRADA Between NRL and General Electric Corporate Research & Development (GECRD)

NRL Principal Investigator: Alma Wickenden, Code 6861
GECRD Principal Investigator: Danielle Walker
Funding: $70,000
Duration: 13 months
Signed: 7 November 2000

The primary objective of this CRADA is the design, growth, fabrication, and testing of photodetectors based on specific GaN and AlGaN/GaN structures on sapphire substrates. The secondary objective of this CRADA is to grow GaN epitaxial layers on bulk GaN substrates.

01-287
A Deployable Fluorescence-Based Biosensor
CRADA Between NRL and Constellation Technology Corporation (CTC)

NRL Principal Investigator: Frances Ligler, Code 6910
CTC Principal Investigator: Timothy A. Postlethwaite
Funding: $91,000
Duration: 7 months
Signed: 27 November 2000

The primary objective of this CRADA is to design a manufacturable version of NRL's array biosensor. A secondary objective is evaluation of alternative approaches for fluorescent labeling that improve detection sensitivity.

01-292
Digital Emergency Medical Service Satellite Networking
CRADA Between NRL and the University of Texas Health Science Center at Houston (UTH)

NRL Principal Investigator: Michael Rupar, Code 5554
UTH Principal Investigator: R. Douglas Tindall
Funding: Each Party will fund its own efforts
Other Government Funding: $842,445 from U.S. Army
Duration: Expires 30 September 2002
Signed: 14 February 2001

The objectives of this CRADA are to (1) perform static and dynamic tests of a Ku-band prototype antenna system (developed under a previous CRADA) on the Digital Emergency Medical Services (Digital EMS) satellite test ambulance in both urban and rural environments and (2) design and integrate a Ka-band satellite-networked system capable of two-way audio, video, and data communication between an ambulance and the UTH facilities.

01-293
Non-Linear Chalcogenide Glasses
CRADA Between NRL and Lucent Technologies (LUCENT)

NRL Principal Investigator: Ishwar Aggarwal, Code 5606
LUCENT Principal Investigator: Richard Slusher
Funding: $50,000
Duration: 12 months
Signed: 12 April 2001

The objectives of this CRADA are to design, fabricate and evaluate glasses and films deposited from those glasses with third-order optical nonlinearities at 1.55 microns at least 500 times that of silica glass and, if possible, to fabricate optical fiber using the optimal materials.

01-297
Chemical/Biological Sensor Algorithm Development
CRADA Between NRL and Triton Systems, Inc. (TSI)

NRL Principal Investigator: Susan Rose-Pehrsson, Code 6116
TSI Principal Investigator: Lowell Burnett
Funding: $50,000
Other Government Funding: $25,000 from DTRA
Duration: 15 months
Signed: 27 June 2001

The objective of this CRADA is to develop a pattern-recognition program based on NRL's patented probabilistic neural network (PNN) algorithm that can identify specific chemical and biological agents using data from TSI's sensors developed outside the scope of this Agreement. The goal is to meet the sensor performance requirements (accuracy, sensitivity, response time, etc.) of TSI's SBIR programs from the Defense Threat Reduction Agency (DTRA) and the U.S. Army under Phase 1 and Phase 2 of the CRADA, respectively.

01-298
Interface Development for an Interactive Case Retrieval Tool
CRADA Between NRL and CDM Technologies, Inc. (CDM)

NRL Principal Investigator: David Aha, Code 5510
CDM Principal Investigator: Michael Zang
Funding: Each Party will fund its own efforts
Duration: 24 months
Signed: 8 June 2001

The objective this CRADA is to develop an Application Programmer's Interface (API) for the Navy Conversational Decision Aids Environment (NaCoDAE) software tool developed by NRL. This API will allow NaCoDAE to be easily integrated as a plug-in module in various decision support architectures.

01-299
A Deployable Fluorescence-based Biosensor
CRADA Between NRL and Constellation Technology Corporation (CTC)

NRL Principal Investigator: R. Andrew McGill, Code 6375
CTC Principal Investigator: Timothy A. Postlethwaite
Funding: $170,000
Duration: 6 months
Signed: 16 April 2001

The goal of this CRADA is to evaluate NRL's existing SAW-based system called pCAD for the purposes of detection and identification of chemical warfare agents and to determine its suitability for integration into a combined chemical-radiation detection system. It is also an objective to identify additional future applications of pCAD and to develop specifications of the systems for those applications.

01-301
Characterization and Analysis of Solar Cell Technologies for Use in the Jovian Environment
CRADA Between NRL and Ball Aerospace & Technologies Corporation (BATC)

NRL Principal Investigator: Robert Walters, Code 6825
BATC Principal Investigator: Kyle Miller
Funding: $75,000
Duration: 12 months
Signed: 26 April 2001

The goals of this CRADA are to develop an understanding of how selected solar cells will operate in the Jovian environment by performing appropriate radiation tests, and to identify the best solar cell technology for minimizing risks associated with the solar arrays during the proposed INSIDE Jupiter Discovery Mission.

01-303
Fast Recovery Time Nuclear Quadrupole Resonance (NQR)
CRADA Between NRL and Quantum Magnetics, Inc. (QM)

NRL Principal Investigator: Allen Garroway, Code 6122
QM Principal Investigator: Lowell Burnett
Funding: Each party will fund its own efforts
Duration: 24 months
Signed: 18 May 2001

The goal of this CRADA is to evaluate QM's advanced fast recovery time electronics system and its ability to improve detection of contraband chemical compounds, including TNT.

CRADA AMENDMENTS

SSC-96-002 (Amendment #3)
Deep-Towed Acoustic/Geophysical System (DTAGS)
CRADA Between NRL and Seafloor Surveys International, Inc. (SSI)

Original NRL Principal Investigator: Joseph Gettrust, Code 7432
Original SSI Principal Investigator: Donald Hussong
Original Funding: $151,500
Original Duration: 12 months
Original Signed: 9 October 1996

One of the objectives of this CRADA is to improve the state of the art of DTAGS and the SSI developed Inverted Short Base Line (ISBL) navigation systems through research. Joint research between the Parties will determine whether coupling the DTAGS with the ISBL would improve the geographical accuracy of NRL's seismic seafloor data interpretation. The joint research would also evaluate whether the ISBL is suitable for deep ocean applications. A second objective of the research is to publish peer-reviewed articles related to basic research and exploratory development achieved cooperatively by the Parties. The goal of the research is to improve the knowledge of seafloor environmental features for naval operation.

Third Amendment
Signed: 7 May 2001
Duration: Extended 24 months. Expires 9 October 2003
The CRADA is amended by modifying the duration in Article 14.2.

98-181 (Amendment #2)
Meteorological Satellite Application System (METSAS)
CRADA Between NRL and Seascape Corporation (SSC)

Original NRL Principal Investigator: Jeffrey Hawkins, Code 7541
Original SSC Principal Investigator: Linda Bernstein
Original Funding: Each Party will fund its own efforts
Original Duration: 36 months
Original Signed: 14 August 1998

The objective of this CRADA is to permit the efficient and timely integration of state-of-the-art satellite meteorological application software from NRL-MRY's research and development laboratory environment to Navy operations via SeaSpace's TeraScan software package.

Second Amendment
Signed: 22 August 2001
Duration: Extended 2 months. Expires 14 October 2001
The CRADA is amended by modifying the duration in Article 14.2.

98-211 (Amendment #3)
Inorganic-Structural Acoustics of Aircraft Interiors
CRADA Between NRL and Cessna Aircraft Interiors (CESSNA)

Original NRL Principal Investigator: Brian Houston, Code 7136
Original CESSNA Principal Investigator: Robert Howes
Original Funding: $120,000
Original Duration: 24 months
Original Signed: 12 August 1998

The objective of this CRADA is to carry out research toward the development of a structural acoustic model of aircraft interior acoustics with the ultimate goal of creating design guidance and tools for a quieter business jet.

Third Amendment
Signed: 16 August 2001
Duration: Extended 6 months. Expires 12 February 2002
The CRADA is amended by modifying the duration in Article 14.2.

99-231 (Amendment #2)
Inorganic-Organic Hybrid Polymers for Aircraft Engine Applications
CRADA Between NRL and United Technologies Corporation - Pratt & Whitney Division (P&W)

Original NRL Program Manager: Teddy Keller, Code 6127
Original P&W Program Manager: Lisa Walla
Original Funding: $75,000
Original Duration: 18 months
Original Signed: 30 March 1999

The objective of this CRADA is to synthesize, characterize, and test the high temperature properties of a series of inorganic-organic hybrid polymers in order to assess their suitability for application in aircraft components that must withstand high temperatures. A further objective is to develop scaled-up synthesis, curing, and molding procedures in anticipation of commercialization.

Second Amendment
Signed: 8 June 2001
Duration: Extended 12 months. Expires 30 September 2002
The CRADA is amended by modifying the duration in Article 14.2.

99-244 (Amendment #2)
Nuclear Magnetic Resonance (NMR) of Deep-Sea Gas Hydrate Formation
CRADA Between NRL, Monterey Bay Aquarium Research Institute (MBARI) and Schlumberger Technology Corporation (STC)

Original NRL Principal Investigator: James Yesinowski, Code 6120
Original STC Principal Investigator: Robert Kleinberg
Original MBARI Principal Investigator: Peter Brewer
Original Funding: Each Party will fund its own efforts
Original Duration: 12 months
Original Signed: 23 September 1999

The objectives of this CRADA are to: (1) explore a fundamentally new approach using NMR to investigate gas hydrate formation over long durations in the marine environment; (2) begin providing experimental results that can be used to assess the realism of theoretical models of hydrate formation based on considerations of fluid flow in porous media, etc.; and (3) gain experience for future possible applications from the first use of NMR in the deep-sea environment.

Second Amendment
Signed: 10 April 2001
Duration: Extended 12 months. Expires 23 March 2002
The CRADA is amended by modifying the duration in Article 14.2.

99-246 (Amendment #1 and #2)
Tripod Operators for Determining the Pose of Industrial Parts in Six Degrees of Freedom
CRADA Between NRL and Perceptron Inc., The Ford Motor Company, Microdexterity Systems Inc., and The National Center for Manufacturing Sciences Inc. (PFMN)

Original NRL Principal Investigator: Frank Pipitone, Code 5510
Original PFMN Principal Investigator: Matthew Collins
Original Funding: $125,000
Original Duration: 12 months
Original Signed: 28 September 1999

The objective of this CRADA is to develop software which can, using range data, estimate the pose in 6-DOF of an industrial part with sufficient accuracy and speed to allow the successful and timely grasping of palletized parts during an automotive assembly operation.

First Amendment
Signed: 7 November 2000
Duration: Extended 2 months. Expires 28 November 2000
The CRADA is amended by modifying the duration in Article 14.2.

Second Amendment
Signed: 28 December 2000
Funding: Additional $125,000
Duration: Extended 10 months. Expires 30 September 2001
The CRADA is amended by modifying the payment schedule in Article 8.1, the duration in Article 14.2, and the Statement of Work in Appendix A.

99-249 (Amendment #2)
Fiber-Optic Oil Well Sensors
CRADA Between NRL and Halliburton Energy Systems (HES)

Original NRL Principal Investigator: Anthony Dandridge, Code 5670
Original HES Principal Investigator: John R. Dennis
Original Funding: $100,000
Original Duration: 12 months
Original Signed: 15 July 1999

The objective of this CRADA is to develop a high performance fiber-optic sensor system for monitoring conditions in oil wells, particularly pressure and temperature.

Second Amendment
Signed: 28 February 2001
Duration: Extended 12 months. Expires 15 January 2002
The CRADA is amended by changing the HES Principle Investigator in Article 6.2.2 and modifying the duration in Article 14.2.

99-251 (Amendment #3)
Digital Emergency Medical Service (DEMS) Satellite Networking
CRADA Between NRL and The University of Texas Health Science Center at Houston (UTH)

Original NRL Principal Investigator: Michael A. Rupar, Code 5554
Original UTH Principal Investigator: R. Douglas Tindall
Original Funding: $100,000
Original Duration: 6 months
Original Signed: 5 August 1999

The objective of this CRADA is to develop a prototype satellite-networked system capable of two-way audio, video, and data communication between an ambulance and a hospital trauma center, and to test it in the Houston area with the DEMS network.

Third Amendment
Signed: 29 October 2000
Duration: Extended 6 weeks. Expires 11 November 2000
The CRADA is amended by modifying the duration in Article 14.2.

00-265 (Amendment #2 and #3)
Signal Processing for Fiber Optic Medical Sensors
CRADA Between NRL and Advanced Sensor Technology (AST)

Original NRL Principal Investigator: Sandeep T. Vohra, Code 5673
Original AST Principal Investigator: Frank Bucholtz
Original Funding: $60,000 if tasks 1-4 performed or $53,000 if only tasks 1, 2,and 4 performed
Original Duration: 6 months
Original Signed: 9 March 2000

The objectives of this CRADA are to develop and test an electro-optical signal processor for use with a fiber-optic sensor for medical applications and to transfer knowledge of the design and fabrication of electro-optical signal processors from NRL to AST.

Second Amendment
Signed: 14 February 2001
Duration: Extended 6 months. Expires 9 July 2001
The CRADA is amended by modifying the duration in Article 14.2.

Third Amendment
Signed: 22 June 2001
Duration: Extended approximately 3 months. Expires 30 September 2001
The CRADA is amended by modifying the duration in Article 14.2.

00-268 (Amendment #2 and #3)
Investigation of Increased Spontaneous Fission Rate of 235-U Under Acoustic Compression
CRADA Between NRL and JWK International Corporation (JWK)

Original NRL Principal Investigator: Robert August, Code 6173
Original JWK Principal Investigator: Lawrence P.G. Forsley
Original Funding: Each party will fund its own efforts
Original Duration: 4 months
Original Signed: 27 April 2000

The objective of this CRADA is to verify the conditions of supercritical fission by monitoring the spontaneous fission rate of nearly pure 235-U in aqueous solution during cavitation. If an increase in the fission rate is observed, NRL and JWK will plan follow-on research and seek additional funding.

Second Amendment
Signed: 1 March 2001
Duration: Extended 6 months. Expires 27 August 2001
The CRADA is amended by modifying the duration in Article 14.2.

Third Amendment
Signed: 4 September 2001
Duration: Extended 8 months. Expires 27 April 2002
The CRADA is amended by modifying the duration in Article 14.2.

00-269 (Amendment #2)
Pulsed Laser Deposition of Ferroelectric Thin Films for Tunable Microwave Devices
CRADA Between NRL and Paratek Microwave, Inc. (PARATEK)

Original NRL Principal Investigator: James Horwitz, Code 6372
Original PARATEK Principal Investigator: Xubia Zhang
Original Funding: $40,000
Original Duration: 9 months
Original Signed: 18 May 2000

The objective of this CRADA is to obtain a thin film material that exhibits a loss tangent of 0.004 at 10 GHz and a tunability of 30 percent for a 10-volt bias.

First Amendment
Signed: 25 September 2000
Funding: Additional $3,000
The CRADA is amended by modifying the funding in Article 8.1 and the Statement of Work in Appendix

Second Amendment
Signed: 8 March 2001
Funding: Additional $40,000
The CRADA is amended by modifying the funding in Article 8.1, the quarterly reports in Article 9.1 and the Statement of Work in Appendix A.

00-275 (Amendment #1)
Combination of Ion-Mobility Spectrometry (IMS) and Surface Acoustic Wave (SAW) Technology in a Single Chemical Agent Detector
CRADA Between NRL and Graseby Dynamics, Ltd. (GDL)

Original NRL Principal Investigator: R. Andrew McGill, Code 6370
Original GDL Principal Investigator: Basil Polychranopoulos
Original Funding: $250,000
Original Duration: 12 months
Original Signed: 2 October 2000

The objective of Phase I of this CRADA is to evaluate the feasibility of combining NRL's SAW and GDL's IMS sensor technologies into a single chemical agent detector that is more robust and less prone to false positive or false negative alarms. The objective of Phase II of this Agreement is to develop the hardware and software for an integrated IMS-SAW detector.

First Amendment
Signed: 23 April 2001
Duration: 12 original months. Expires 2 October 2001
The CRADA is amended by modifying the payment schedule in Article 8.1.

00-285 (Amendment #1)
Development of AlGaN/GaN Ultraviolet Sensors
CRADA Between NRL and General Electric Corporate Research & Development (GECRD)

Original NRL Principal Investigator: Alma Wickenden, Code 6861
Original GECRD Principal Investigator: Danielle Walker
Original Funding: $70,000
Original Duration: 13 months
Original Signed: 7 November 2000

The primary objective of this CRADA is the design, growth, fabrication, and testing of photodetectors based on specific GaN and AlGaN/GaN structures on sapphire substrates. The secondary objective of this CRADA is to grow GaN epitaxial layers on bulk GaN substrates.

First Amendment:
Signed: 29 June 2001
Duration: 13 original months. Expires 7 December 2001
Funding: Reduced to $50,000
The CRADA is amended by modifying the Summary in Article 2, the Objective in Article 5, NRL Personnel in Article 6.2.1, the payment schedule in Article 8.1, and the Statement of Work in Appendix A.

01-287 (Amendment #1)
A Deployable Fluorescence-Based Biosensor
CRADA Between NRL and Constellation Technology Corporation (CTC)

Original NRL Principal Investigator: Frances Ligler, Code 6910
Original CTC Principal Investigator: Timothy A. Postlethwaite
Original Funding: $91,000
Original Duration: 7 months
Original Signed: 27 November 2000

The primary objective of this CRADA is to design a manufacturable version of NRL's array biosensor. A secondary objective is evaluation of alternative approaches for fluorescent labeling that improve detection sensitivity.

First Amendment
Signed: 3 July 2001
Duration: Extended 2 months. Expires 27 August 2001
The CRADA is amended by modifying the field of use in Article 10.3.4 and the duration in Article 14.2

01-293 (Amendment #1)
Non-Linear Chalcogenide Glasses
CRADA Between NRL and Lucent Technologies (LUCENT)

Original NRL Principal Investigator: Ishwar Aggarwal, Code 5606
Original LUCENT Principal Investigator: Richard Slusher
Original Funding: $50,000
Original Duration: 12 months
Original Signed: 12 April 2001

The objectives of this CRADA are to design, fabricate and evaluate glasses and films deposited from those glasses with third-order optical nonlinearities at 1.55 microns at least 500 times that of silica glass and, if possible, to fabricate optical fiber using the optimal materials.

First Amendment
Signed: 29 June 2001
Duration: Original 12 months. Expires 12 April 2002
Funding: Payment divided. $25,000 in June 2001 and $25,000 in October 2001
The CRADA is amended by modifying the payment schedule in Article 8.1.

CRADAs TERMINATED OR EXPIRED

95-079 (Expired 23 October 2000)
Quantitative Mobility Spectrum Analysis for Hall Evaluation Software Package
CRADA Between NRL and Lake Shore Cryotronics, Inc. (LSCI)

Original NRL Principal Investigator: Jerry R. Meyer, Code 5613
Original LSCI Principal Investigator: John K. Krause
Original Funding: $50,000
Original Duration: 24 months
Original Signed: 23 July 1996

The objective of this CRADA was to develop and make available to the semiconductor community a software package based on the Quantitative Mobility Spectrum Analysis (QMSA) algorithm for evaluating magnetic-field-dependent Hall and resistivity measurements. The package may be used either as a built-in component of Lake Shore Hall instrumentation or in conjunction with data acquired by any other Hall system. By providing a more accurate and computer-automated analysis algorithm than has been available previously, this CRADA will lead to significantly enhanced capabilities for routinely characterizing multiple electron and hole densities and mobilities in semiconductor samples, including bulk, thin film, and quantum well materials and devices. Suitable for use by both experts and non-experts, the product will benefit Navy, other Department of Defense, industrial, and university laboratories and production facilities involved in the development and characterization of semiconductor materials and devices.

First Amendment
Signed: 10 March 1998
Funding: Additional $7500
Duration: Expired 31 December 1998
The CRADA was amended by modifying the payment schedule in Article 8.1, the duration in Article 14.2, and the Statement of Work in Appendix A.

Second Amendment
Signed: 19 February 1999
Funding: Additional $20,000
Duration: Additional 7 months. Expired 23 July 1999
The CRADA was amended by modifying the payment schedule in Article 8.1, the duration in Article 14.2, and the Statement of Work in Appendix A.

Third Amendment
Signed: 28 July 1999
Funding: Additional $20,000
Duration: Additional 6 months. Expired 23 January 2000
The CRADA was amended by modifying the payment schedule in Article 8.1 and the duration in Article 14.2.

Fourth Amendment
Signed: 3 February 2000
Duration: Extended 6 months. Expired 23 July 2000
Funding: Payment schedule modified
The CRADA was amended by modifying the payment schedule in Article 8.1 and the duration in Article 14.2.

Fifth Amendment
Signed: 21 July 2000
Duration: Extended 3 months. Expired 23 October 2000
The CRADA was amended by modifying the duration in Article 14.2.

96-119 (Expired 1 October 2000)
Radiation Hardness In Thin Simox
CRADA Between NRL and Ibis Technology Corporation (IBIS)

Original NRL Principal Investigator: Harold Hughes, Code 6816
Original IBIS Principal Investigator: Lisa Allen
Original Funding: $120,000
Original Duration: 12 months
Original Signed: 20 February 1997

The objective of this CRADA was to determine optimal processes parameters to maximize radiation hardness of thin box SIMOX.

First Amendment
Signed: 4 May 1998
Duration: Expired 1 April 1999
The CRADA was amended by modifying the duration in Article 14.2.

Second Amendment
Signed: 1 April 1999
Duration: Additional 12 months. Expired 1 April 2000
The CRADA was amended by modifying the duration in Article 14.2.

Third Amendment
Signed: 30 March 2000
Duration: Extended 3 months. Expired 1 July 2000
Ibis Principal Investigator: Michael L. Alles
The CRADA was amended by modifying the Ibis Personnel in Article 6.2.2 and the duration in Article 14.2.

Fourth Amendment
Signed: 30 June 2000
Duration: Extended 3 months. Expired 1 October 2000
The CRADA was amended by modifying the duration in Article 14.2.

97-142 (Expired 31 January 2001)
Diamond Based Materials Research
CRADA Between NRL and Diamond Microelectronics Corporation (DMC)

Original NRL Principal Investigator: Pehr Pehrsson and James Butler, Code 6174
Original DMC Principal Investigator: Ross James
Original Funding: $500,000
Original Duration: 24 months
Original Signed: 13 March 1997

The objective of this CRADA was to develop cost-effective diamond-based, high power/high frequency switches and assorted vacuum electronics.

First Amendment
Signed: 1 April 1999
Funding: Additional $550,000
Duration: Extended 13 months. Expired 13 April 2000
The CRADA was amended by modifying the payment schedule in Article 8.1, the duration in Article 14.2, and the Statement of Work in Appendix A.

Second Amendment
Signed: 15 July 1999
Funding: Additional $25,000
Duration: No change. Expired 13 April 2000
The CRADA was amended by modifying the NRL personnel in Article 6.2.1, the payment schedule in Article 8.1 and the Statement of Work in Appendix A.

Third Amendment
Signed: 27 October 1999
NRL Principal Investigators: Pehr Pehrsson, James Butler, Code 6174 and John Shaw, Code 6840
Funding: $472,000
Duration: Extended 6 months. Expired 13 October 2000
The CRADA was amended by modifying the NRL Personnel in Article 6.2.1, the payment schedule in Article 8.1, the duration in Article 14.2, and the Statement of Work in Appendix A.

Fourth Amendment
Signed: 31 August 2000
DMC Principal Investigator: Bryant Cushing
Funding: Modified payment schedule
Duration: Extended 3 months. Expired on 31 January 2001
The CRADA was amended by modifying the DMC Personnel in Article 6.2.2 and Article 13.2.6, the payment schedule in Article 8.1 and the duration in Article 14.2.

97-162 (Expired 16 January 2001)
Advanced Radar Modeling and Simulation Tool for Electronic Warfare Research
CRADA Between NRL and Photon Research Associates (PRA)

NRL Principal Investigator: Allen Duckworth, Code 5707
PRA Principal Investigator: Pat Wiley
Funding: Each Party will fund its own efforts
Duration: 36 months
Signed: 16 January 1998

The objective of the CRADA was to develop a modular, reconfigurable, distributed, interactive radar simulation (RADSIM) that can be seamlessly integrated into the NRL ENEWS M&S framework.

97-163 (Expired 8 October 2000)
X-Ray Absorption Analysis and Experiments
CRADA Between NRL and PPG Industries, Inc. (PPG)

NRL Principal Investigator: Michael Bell, Code 6680
PPG Principal Investigator: Joseph Fletcher
Funding: $69,000
Duration: 36 months
Signed: 8 October 1997

The objective of the CRADA was to develop x-ray absorption spectroscopies (primarily XANES – X-Ray Absorption Near-Edge Spectroscopy and EXAFS – Extended X-Ray Absorption Fine Structure) as tools suitable for studying low concentrations of key elements in glass and fiber glass, as well as coatings (such as automotive coatings) and other organic materials. Such information is intended to be used for analysis, quality control, and forensic science. A further objective is to explore the use of XANES and EXAFS as evidentiary tools in litigation.

97-166 (Expired 12 October 2000)
Anti-Ship Cruise Missile (ASCM) Tactical Analysis Workstation Development
CRADA Between NRL and Sippican, Inc., Hycor Group (HYCOR)

Original NRL Principal Investigator: Allen Duckworth, Code 5707
Original HYCOR Principal Investigator: Richard Porter
Original Funding: $10,000
Original Duration: 6 months
Original Signed: 21 April 1998

The objectives of the CRADA were:
(1) To expand on HYCOR's tactical analysis workstation model to enable modeling of both RF and IR missile engagements; (2) To develop a graphical user interface that can be shared by both the RF and IR missiles; and (3) To perform initial verification and validation efforts on the PC-based workstation model.

First Amendment
Signed: 29 October 1998
Funding: Additional $40,000
Duration: Extended 12 months. Expired 21 October 1999
The CRADA is amended by modifying the payment schedule in Article 8.1, the duration in Article 14.2, and the Statement of Work in Appendix A.

Second Amendment
Signed: 28 October 1999
Funding: $20,000
Duration: Extended 12 months. Expired 21 October 2000
The CRADA was amended by modifying the payment schedule in Article 8.1, the duration in Article 14.2, and the Statement of Work in Appendix A.

98-197 (Terminated 1 April 2001)
Development of Commercial Towed-Array System including a Man-Portable Multisensor Towed Array System (MTADS) Adjunct for Survey of Hazardous Metallic Material
CRADA Between NRL and Blackhawk/Geometrics, Inc. (GEO)

NRL Principal Investigator: Jim McDonald, Code 6110
GEO Principal Investigator: F.L. Clarke
Funding: $175,000
Duration: 36 months
Signed: 30 September 1998

The objectives of the CRADA program were (1) the transfer of NRL's MTADS technology to GEO to allow manufacture and full implementation of one unit of a commercial towed array system for location and identification of buried metallic hazardous material such as unexploded ordnance. Such a system is in high demand by the Department of Defense (DoD) for survey and characterization of current and former military ranges; and (2) the joint development and building by NRL and GEO of one unit of a man-portable adjunct to MTADS. This system will allow GEO to provide commercial services in areas where the vehicular MTADS cannot perform normally.

98-201 (Expired 29 December 2000)
Boundary Element and Finite Element Models for the Application of Nearfield Acoustic Holography
CRADA Between NRL and Automated Analysis Corporation (AAC)

Original NRL Principal Investigator: Brian H. Houston, Code 7136
Original AAC Principal Investigator: Bryce Gardner
Original Funding: $160,000
Original Duration: 24 months
Original Signed: 29 June 1998

The objective of this CRADA was to develop and validate a robust algorithm to identify a noise source based on sound pressure measurements on a surface with an arbitrary shape.

First Amendment
Signed: 22 April 1999
AAC Principal Investigator: S. T. Raveendra
Duration: Original 24 months
The CRADA is amended by modifying the AAC personnel in Article 6.2.2.

Second Amendment:
Signed: 22 June 2000
Duration: Extended 6 months. Expired 29 December 2000
The CRADA was amended by modifying the duration in Article 14.2.

98-204 (Expired 18 December 2000)
Development of Metal-Insulator-Metal Ensemble (MIME) Materials for Chemical Sensing
CRADA Between NRL and Microsensor Systems, Inc. (MSI)

Original NRL Principal Investigator: Arthur Snow, Code 6120
Original MSI Principal Investigator: Hank Wohltjen
Original Funding: $100,000
Original Duration: 12 months
Original Signed: 18 May 1998

The objective of this CRADA program was to explore organic ligand stabilized metal clusters as the critical absorbent and transducer element in a new class of solid-state vapor sensors.

First Amendment
Signed: 20 May 1999
Funding: Additional $100,000
Duration: Extended 19 months. Expires 18 December 2000
The CRADA was amended by modifying the Statement of Work to add new tasks and to amend one task to reflect results obtained in the first eleven months of work. This amendment also added $100,000 in funding, bringing the total to $200,000, and extended the duration by 19 months.

98-211 (Expired 12 August 2001)
Structural Acoustics of Aircraft Interiors
CRADA Between NRL and Cessna Aircraft Company (CESSNA)

Original NRL Principal Investigator: Brian Houston, Code 7136
Original CESSNA Principal Investigator: Robert Howes
Original Funding: $120,000
Original Duration: 24 months
Original Signed: 12 August 1998

The objective of this CRADA was to carry out research toward the development of a structural acoustic model of aircraft interior acoustics with the ultimate goal of creating design guidance and tools for a quieter business jet.

Second Amendment:
Signed: 14 September 2000
Duration: 12 months. Expires 12 August 2001
The CRADA was amended by modifying the duration in Article 14.2.

99-255 (Expired 27 November 2000)
Ka-band Phased Array Antenna
CRADA Between NRL and Paratek Microwave, Inc. (PARATEK)

Original NRL Principal Investigator: J.B.L. Rao, Code 5317
Original Funding: $20,000; Phase I Option=$30,000; Phase II Option=$50,000
Original Duration: 12 months
Original Signed: 27 September 1999

The objective of this CRADA was to demonstrate a phased array antenna that operates at Ka-band frequencies based on a voltage-tunable dielectric lens.

First Amendment
Signed: 25 September 2000
Duration: Extended 2 months. Expires 27 November 2000
The CRADA was amended by modifying the duration in Article 14.2.

00-264 (Expired 12 December 2000)
Microbial Production of Heavy Metal Biosorbents
CRADA Between NRL and MBI International (MBI)

NRL Principal Investigator: Mihran Pazirandeh, Code 6930
MBI Principal Investigator: Thomas L. Deits
Funding: Each party will fund its own efforts
Duration: 8 months
Signed: 12 April 2000

The objective of this CRADA was to combine the capabilities of NRL's metal binding peptides with MBI's expression system to produce a new microbial-based, heavy metal biosorbent.

00-270 (Terminated 29 January 2001)
SiGe Interband Tunneling Diodes
CRADA Between NRL and the University of Delaware (UD)

NRL Principal Investigator: Phillip Thompson, Code 6812
UD Principal Investigator: Paul Berger
Funding: $175,000
Duration: 14 months
Signed: 20 April 2000

The objective of this CRADA was to develop a SiGe resonant interband tunneling diode that has a peak-to-valley current ration (PVCR) greater than 4.

00-276 (Expired 3 November 2000)
Development of Drug Compliance Chemical Detector
CRADA Between NRL and Nanosphere, Inc. (NANOSPHERE)

NRL Principal Investigator: R. Andrew McGill, Code 6370
NANOSPHERE Principal Investigator: James D. Talton
Funding: $30,000
Duration: 3 months
Signed: 22 June 2000

The objective of this CRADA was to develop and demonstrate a SAW sensor array detector that is capable of detecting by breath analysis specific pharmaceuticals or odorant taggants.

Appendix C

FY01 LICENSE REVIEW
1 October 2000 to 30 September 2001

NEW LICENSES

NRL-LIC-01-2-096
Calmar Optcom, Inc.

Nonexclusive License - Signed 29 January 2001
Field of Use: Equipment for optical communication networks and optical networking testing

NRL Patents and Patent Application:

5,303,314	"Method and Apparatus for Polarization-Maintaining Fiber Optical Amplifications with Orthogonal Polarization Output"
5,574,739	"Polarization-Stable Pulsed Laser
09/566,236	(NC 79,766) "An Ultra Short-Pulsed Fiber Laser with a Dispersion Managed Cavity"

Inventors:

Thomas Carruthers	Code 5654
Irl Duling III	Code 5671
Ronald Esman	Code 5650
Michael Dennis	Code 5654

NRL-LIC-00-2-085
Codeon Corporation

Nonexclusive License - Signed 10 October 2000
Field of Use: Integrated optical devices for telecommunications

NRL Patents:

5,195,163	"Fabrication and Phase Tuning of an Optical Waveguide Device"
5,259,061	"Fabrication and Phase Tuning of an Optical Waveguide Device"

Inventors:

W.K. Burns	Code 5671
C.H. Bulmer	Code 5671
A.S. Greenblatt	Code 5671

NRL-LIC-00-11-094
Fibertek, Inc.

Nonexclusive License - Signed 4 January 2001
Field of Use: Fiber Amplifiers for optical communication, laser transmitters, coherent and pulsed laser radar, infrared countermeasures and chemical sensors

NRL Patent:
5,854,865 "Method and Apparatus for Side Pumping an Optical Fiber"

Inventor:
Lew Goldberg Code 5670.2

NRL-LIC-99-21-082
IMRA America, Inc.

Nonexclusive License - Signed 29 October 2000
Field of Use: Fiber amplifiers for lasers for materials processing, test and measurement instrumentation, laser printing, laser displays, and scientific applications in a research and development environment

NRL Patent:
5,854,865 "Method and Apparatus for Side Pumping an Optical Fiber"

Inventor:
Lew Goldberg Code 5670.2

NRL-LIC-99-19-080
Marine Desalination Systems, LLC

Partially Exclusive License - Signed 7 December 2000
Field of Use: Desalination and purification of water for state, local, municipal and non-public water supply.

NRL Patent and Patent Application:
5,873,262 "Desalination Through Methane Hydrate"
09/195,159 "Desalination Through Methane Hydrate"

Inventors:
Michael D. Max Code 7420
Robert E. Pellenbarg Code 6101

NRL-LIC-99-9-070
Smart Surfaces, LLC

Partially Exclusive License - Signed 28 February 2001
Field of Use: Manufacture and use of fouling release coatings and the application of such coatings to boat and ship hulls and to power plant intake and discharge pipelines.

NRL Patents:

5,449,553	"Nontoxic Antifouling Systems"
5,593,732	"Nontoxic Antifouling Systems"

Inventor:

James R. Griffith Code 6115

MODIFICATIONS TO EXISTING LICENSES

NRL-LIC-96-014
American Pipe Lining, Inc.

Partially Exclusive License - Signed 14 August 1996
1st Modification – Signed 6 February 2001
Field of Use: In-place pipe cleaning and epoxy lining services for potable water systems.

The License was modified to extend the period of exclusivity of the license by two (2) years, to acknowledge mutually agreed upon changes to the business plan, and to clarify the royalty rate.

NRL Patent:

5,707,702 Epoxy Pipelining Composition and Method of Manufacture

Inventors:

Robert F. Brady, Jr Code 6132
James D. Adkins

NRL-LIC-00-5-088
Nova Engineering/University of Maryland

Nonexclusive License - Signed 16 August 2000
1st Modification – Signed 14 February 2001
Field of Use: Wireless radio transceivers

The License was modified to change the distribution of royalties to each of the co-licensors (NRL and University of Maryland). This change was required as a result of a change in legislation regarding the sharing of royalties with inventors (Morella Bill amendments to Public Law 106-104, 15 USC §3710a).

NRL Patent Applications:

09/266,868	Adaptive Routing Method for a Dynamic Network
09/513,245	A Method for Eliminating Synchronized Clocks in Distributed Routing Approaches that are Dependent on Temporal Ordering of Events

Inventors:

Vincent Park	Code 5520
Mathew Corson	University of Maryland

LICENSES TERMINATED

NRL-LIC-93-001
Arnold Engineering Company

Nonexclusive License – Signed 19 July 1993
Field of Use: Rare earth magnet alloys
Mutual Termination Agreement - Signed 18 June 2001, effective 1 August 2001

The company initiated the request to terminate due to the unfavorable ruling by the USPTO on the interference between the NRL patents and patents assigned to Magnequench.

NRL Patents:

4,402,770	Hard Magnetic Alloys of a Transition Metal and Lanthanide
4,409,043	Amorphous Transition Metal-Lanthanide Alloys
4,533,408	Preparation of Hard Magnetic Alloys of a Transition Metal and Lanthanide

Inventor:

Norman C. Koon	Code 6340

NRL-LIC-95-002
Lifepoint, Inc. (formerly U.S. Alcohol, Substance Abuse Technologies, Inc., and U.S. Drug Testing, Inc.)

Partially Exclusive License – Signed 24 January 1992
Field of Use: Drugs of Abuse
Terminated 16 August 2001 by mutual agreement

This license termination corresponds to the execution of a new license between NRL and Lifepoint under different terms reflecting the changes to Lifepoint's business plan.

NRL Patents:

5,183,740	Flow Immunosensor Method and Apparatus
3,354,654	Lyophilized Ligand-Receptor Complexes for Assay and Sensors

Inventors:

Frances Ligler	Code 6908
Bruce Gaber	Code 6930
Anne Kusterbeck	Code 6901
Gregory Wemhoff	
James Whelan	

NRL-LIC-95-001
Diamond Microelectronics Corporation

Partially Exclusive License – Signed 23 February 1995
Field of Use: High performance diamond based electronic devices
Terminated 31 August 2001

This license was terminated by NRL for breach of agreement.

NRL Patents:

5,269,890	Electrochemical Process and Product Therefrom
5,587,210	Growing and Releasing Diamonds
5,702,586	Polishing Diamond Surfaces

Inventors:

Pehr Pehrsson	Code 6174
Michael Marchywka	

NRL-LIC-98-9-046
Graviton, Inc.

Partially Exclusive License – Signed 30 March 1999
Field of Use: (1) Pharmaceutical drug discovery (2) clinical and non-clinical diagnostics for biological applications, and (3) chemical sensors for applications in passive environmental monitoring, active process monitoring and portable gas monitoring devices, but not including the detection of explosives or explosive devices.
Terminated 28 July 2001

This license was terminated by NRL for breach of agreement.

NRL Patents and Patent Applications

5,372,930	Sensor for Ultra-Low Concentration Molecular Recognition
5,807,758	Chemical and Biological Sensor Using an Ultra-Sensitive Force Transducer
08/794,979	Biosensor Using Magnetically-Detected Label
09/008,782	Force Discrimination Assay
09/074,541	Apparatus and Method for Measuring Intermolecular Interactions by Atomic Force Microscopy

Inventors:

Richard J. Colton	Code 6170
David A. Kidwell	Code 6177
Gil U. Lee	Code 6170
David Baselt	
John-Bruce D. Green	

APPENDIX D

REVIEW OF FY01 WORK FOR PRIVATE PARTIES
1 October 2000 to 30 September 2001

Services Approved Under 10 U.S.C. § 2539b:
(Provide testing to non-Federal parties)

$ 32,600	Test electrical characteristics of buried oxide regions by X-ray irradiation of SIMOX test device wafers
$ 44,000	Use NRL procedures to evaluate data to determine mechanisms for solar array degradation
$ 125,000	Perform radiation testing on solar cells
$ 37,875	Test a continuous flow immunosensor for the development of a rapid, sensitive, and specific assay for the detection of estradiol and estrone in freshwater and seawater
$ 8,000	Perform total dose irradiation testing on voltage regulators
$ 125,000	Perform irradiation testing on solar cells
$ 37,900	Use NRL's Infrared Range facility to test proprietary articles
$ 42,000	Perform military specification testing of Aqueous Film Forming Foam
$ 5,905	Test manpower and test equipment
$ 480	Test samples from an airline crash
$ 5,000	Use NRL's Pulsed Laser Facility to perform testing on a part
$ 92,820	Perform environmental testing of the Coriolis Development Test Vehicle
$ 10,000	Test the infrared reflectivity and transmission of lead-salt mirror stacks and vertical-cavity surface-emitting lasers
$ 310,000	Test AEGIS weapons systems
$ 35,000	Perform proton irradiation testing of dual- and triple-junction solar cells
$ 911,580	

Services Approved Under 10 U.S.C. § 2563:
(Provide services and supplies to non-Federal parties)

$ 25,000	Support DD21 test with expertise in Multivariate Data Reduction
$6,000,000	Support five Special Sensor Ultraviolet Limb Imager sensors to be flown by the U.S. Air Force
$ 124,000	Fly NRL's Salinity, Temperature and Roughness Remote Scanner in airborne remote sensing campaign sponsored by the European Space Agency
$ 20,000	Consult and provide test diamond coatings for private party's role in a DARPA program
$ 50,000	Analyze infrared electron spin resonance and Raman measurements of quartz samples and make recommendations on related specifications and manufacturing processes
$ 15,000	Supply 15 silicon-based wafers which have p^+ ultrashallow doped layers
$ 20,000	Characterize performance of Field Emitter Array Cathodes for NASA funded effort
$ 2,200	Develop light modulator technique for fiber-optic submarient communication
$6,256,200	